Climate Change and Human Health Literature Portal

National Institute of
Environmental Health Sciences

Wildland fire management and air quality in the southern Sierra Nevada: Using the Lion Fire as a case study with a multi-year perspective on PM2.5 impacts and fire policy

Author(s):	Schweizer D, Cisneros R
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Abstract:

Management of fire is an important and controversial policy issue. Active fire suppression has led to a backlog of fuels, limited the ecological benefits of fire, and reduced short-term smoke impacts likely delaying these emissions to future generations over a larger spatial extent. Smoke impacts can be expected to increase as fire size and intensity increase and the fuel backlog is consumed; whether through reintroduction of fire under desirable conditions or through stand replacing fire. Land Management Agencies would like to increase the use of naturally ignited fires to burn during favorable conditions as a way to reduce catastrophic fires. This study provides information about the levels of air quality impacts expected from these types of fires and discusses some of the policy controversies of managed fire that propagate inconsistencies between agencies and enter the public discourse. The Lion Fire, a primarily low intensity 8,370ha fire that was extensively monitored for Particulate Matter less than 2.5 microns (PM2.5), is used to quantify impacts to air quality. PM2.5 monitoring sites are used to assess exposure, public health impacts, and subsequently quantify annual air quality during a year with a fire that is within the historic normal fire size and intensity for this area. Ground level PM2.5 impacts were found to be localized with 99% of the hourly Air Quality Index readings in the moderate or good category for the sites impacted by the fire. PM2.5 concentrations at sites nearest the fire were below annual federal air quality standards for PM2.5 with annual 98th percentile at the most impacted sites (Johnsondale, Kernville, and Camp Nelson) of 35.0, 34.0, and 28.0µgm-3 respectively. Smoke impacts to PM2.5 concentrations were not found to reach the populated Central Valley. The findings suggest that this type of fire can be implemented with minimal public health impacts thus allowing an opportunity for air and fire managers to alter policy to allow additional burning in an area with severe anthropogenic air pollution and where frequent widespread fire is both beneficial and inevitable. The more extensive air quality impacts documented with large high intensity fire may be averted by embracing the use of fire to prevent unwanted high intensity burns. A widespread increase in the use of fire for ecological benefit may provide the resiliency needed in Sierra Nevada forests as well as be the most beneficial to public health through the reduction of single dose exposure to smoke and limiting impacts spatially.

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Resource Description

Exposure : ☒

weather or climate related pathway by which climate change affects health

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Air Pollution, Extreme Weather Event

Air Pollution: Particulate Matter

Extreme Weather Event: Wildfires

Geographic Feature: ☒

resource focuses on specific type of geography

Rural

Geographic Location: ☒

resource focuses on specific location

United States

Health Impact: ☒

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Intervention: ☒

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation: ☒

mitigation or adaptation strategy is a focus of resource

Adaptation

Resource Type: ☒

format or standard characteristic of resource

Policy/Opinion, Research Article

Resilience: ☒

capacity of an individual, community, or institution to dynamically and effectively respond or adapt to shifting climate impact circumstances while continuing to function

A focus of content

Timescale: ☒

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment: ☒

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content